February 9th.

SIR WM. R. HAMILTON, LL.D., President, in the Chair.

Richard Cane, Robert Franks, Charles W. Levinge, James Corry Sherrard, Pierce Morton, and Stephen O'Meagher, Esqrs., were elected Members of the Academy.

Mr. Robert Mallet read part of his paper on the Mechanics of Earthquakes.

The author first notices the various instances recorded of an apparently vorticose motion having occurred in earthquakes, as evidenced by the twisting displacement of objects, such as the superimposed stones of obelisks, &c., and then proceeds to demonstrate that the conclusion adopted by Mr. Lyell and other authors, that such a vorticose motion actually takes place, does not follow from the premises, and is inconceivable and impossible in many respects.

He proves that the twisting displacement is due to a mere alternate, straight-line motion, given by the earthquake-shock to the base upon which the displaced body rests. The insistent body is moved by the adhesion of its base, and its inertia, acting through its centre of gravity, will cause the body to twist whenever the point in the base, at which all the adhesion may be supposed to act, and which the author calls "the centre of adherence," lies either to one side or the other of a vertical plane, passing through the centre of gravity of the body twisted, and being on the line of motion of the base.

The alternate, straight-line motion having such great velocity, yet within narrow limits, as thus to move heavy bodies by their inertia, and which constitutes the earthquake-shock, the author defines as the passage of a wave of elastic com-

pression though the solid crust of the earth, produced at any distant points, by any original sufficient impulse, such as the sudden bending, by elevation or depression, or the rupture of a portion of the earth's crust.

From this single principle, viz., that the true earthquake-shock consists simply in the transit through the solid crust of the earth of a wave of elastic compression, which the author believes to be now, by him, for the first time, enunciated, he proceeds to develope and account for, in detail, all the more important recorded phenomena of earthquakes, as well as many of the more perplexing secondary phenomena.

The original impulse, or origin of an earthquake, may be either under the sea, or on land, at a distance from the sea. In the former case, at the moment of originating the impulse, whether by bending or fracture, several distinct sets of waves set out from the same points, and at the same moment of time, but they move with very different velocities.

The wave of elastic compression, or great earth-wave of the author, makes its transit through the solid crust, outwards, in all directions, from the point or points of impulse, and moving at a speed proportionate to the specific elasticity and density of the formations through which it passes. This, the author shews, may be as much as 11,000 feet per second. This wave constitutes a real undulation of the surface through which it is passing, and may be also (if there is fracture at the origin) heard as a sound-wave in the solid, moving at the same rate. A sound-wave also travels through the water of the sea, and, moving more slowly than in the solid, is heard upon land after the shock has passed. Lastly, a rolling wave of translation, or great sea-wave of the author, is formed by the movement of the bottom, directly above the originating disturbance. This sea-wave, though setting out at the same moment as the shock or earth-wave, is rapidly outstripped by the latter—because its motion is dependent upon its own form and magnitude, and upon the depth of the sea upon and

through which it moves. The great sea-wave, therefore, comes to land long after the shock has passed, and may be followed by several in succession, into which the original great sea-wave has broken, where the form of the soundings in-shore are suitable.

The apparent recession of the sea just at the moment of the earthquake-shock reaching the land, the author shows, is to be accounted for by a small undulation of the sea, carried, as it were, upon the back of the earth-wave, and moved along at its speed, and which he has called the "forced sea-wave." Such are the usual train of circumstances when the centre of disturbance is under the sea, accompanied, in addition, by a sound-wave through the air, when rupture of the crust has occurred.

When the centre of disturbance is far inland, the "great earth-wave" and sound-wave through the solid, with the sound-wave through the air, and the "forced-wave" upon the shore, are the only ones that can occur.

Dr. Apjohn observed, that Mr. Mallet appeared to him not only to state very correctly how the onward motion of the earth's crust, produced by an earthquake, might cause the upper stones of a pillar of masonry to be deranged from their position in the line of such motion, but also to have suggested, for the first time, the true cause of their partial rotation, or displacement in azimuth. In endeavouring, however, to remove the obvious objection to this explanation, viz., that the *returning movement* should restore such disturbed masses to their original position, he (Dr. Apjohn) could not but think that Mr. Mallet had introduced speculations as to the mechanism of terrestrial wave-motion, which, though very ingenious, appeared somewhat far-fetched and obscure, and, unless he (Dr. Apjohn) was much mistaken, certainly not necessary to the solution of the difficulty in question. In fact, it is impossible that the displacement produced by the forward motion could be *undone* by the returning stroke, unless upon a hypothesis

almost infinitely improbable, viz., that, after the displacement, what Mr. Mallet calls the centre of adhesion shall have, in relation to the centre of gravity, such a position, that the moment of the weight of the displaced masses, referred to the centre of adhesion, shall have its original value, and tend, at the same time, to produce a motion of rotation opposite to that which has already occurred. Now, in order to this, the centre of adhesion must continue at the same side of the line of direction of the earthquake-movement passing through thecentre of gravity of the displaced materials, and we must also have $d \times \sin \theta' = d' \times \sin \theta'$, d and d' being the distance between centre of gravity and centre of adhesion before and after the first displacement, and θ and θ' the angles made by the direction of earthquake-movement with the lines connecting centre of gravity with centre of adhesion. It is scarcely necessary to say, that the fulfilment of such conditions in any particular case must be in the highest degree improbable.

The Secretary of the Academy read the second part of the Rev. Dr. Hincks' paper on Phonetic Hieroglyphics:

The object of the second part is to shew what data are most to be relied on for determining the exact powers of the Egyptian letters; the existence of an approximate alphabet is assumed, and the knowledge of facts grounded on the general correctness of this is to be applied to determine the exact alphabet. It is remarked, in the first place, that, as the powers of the letters probably varied at different times and in different parts of Egypt, it is necessary to assume a particular place and time, the alphabet of which is to be investigated. The place chosen is Thebes, and the time the interval between the deaths of the first and third kings of the name of Rameses, during which the principal sculptures at Thebes were executed, and the papyri in the British Museum, of which facsimiles have been published, were written. The data which